

# *Cortinarius* Fr. Subgenus *Cortinarius* in Australia

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Three new species within *Cortinarius* subgenus *Cortinarius* from Australia are described, each belonging near a different species, but differing significantly from the type variety in all cases. They represent distinct species – *C. jenolanensis*, *C. kioloensis* and *C. hallowellensis*.

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## INTRODUCTION

*Cortinarius* subgenus *Cortinarius* is characterised by the presence of fleshy carpophores, with a cap that is frequently squamulose, large conspicuous cheilocystidia and vacuolar, mostly violet, pigments. The spores show both a suprapilar plage, usually flattened and often more or less smooth.

There have been scattered records of this subgenus, particularly *C. violaceus* from Australia. This species was reported from Victoria by Cooke (1892) and this report was carried forward by McAlpine (1895) and Brittlebank (1940). Cleland (1933, 1934) did not record the species, nor did Grgurinovic (1997) record it from South Australia. Shepherd and Totterdell (1988) recorded the species from the Australian Capital Territory, New South Wales and Victoria. Young (1994) also recorded the species from New South Wales and Victoria. This species was also recorded from Western Australia by Griffiths (1985), Hilton (1988) and Syme (1992) and more recently was fully described by Bougher and Syme (1998). All these records are for *C. violaceus*, in some cases with uncertainty being expressed as to whether the collections are identical with the European species. Recently a new species, *Cortinarius austroviolaceus* has been described from Tasmania by Gasparini (2001).

There have been some recent studies on *C. violaceus* in Europe and now two species are widely recognised, *C. violaceus* and *C. hercynicus* (Brandrud 1983; Brandrud *et al.* 1989-1998). The study by Moser (1986) of some collections from the SW-Pacific area has added four more species to the subgenus *C.*

*atroviolaceus*, *C. subcalyptosporus*, *C. atrolazulinus* and *C. paraviolaceus*. In view of the diversity of taxa of the subgenus in the SW Pacific, the suggestion has been made that they represent the descendants of a Gondwanan species of possibly ancient origin (Gasparini, 2001). However the subgenus has not been reported from Tierra del Fuego (Horak 1979) or in other areas of South America (Moser and Horak 1975). *Cortinarius violaceus* s.s. Montagne, (from Chile, see Horak, 1979) is a different, unrelated species, *Cortinarius gayii* Horak (see Horak, 1979, p. 396 with full description).

There has been considerable discussion over many years as to whether *Cortinarius violaceus* is a single species in Europe or whether several taxa at some close level (species, subspecies or variety) are involved. Some claim that over a large number of collections, a continuous variation can be found between the two main forms. However many now recognise two distinct forms, though the level at which they should be considered is also disputed. The view taken here (following Moser (1983), Horak (2005), Breitenbach & Kranzlin (2000) and Knudsen & Vesterholt (2008)) is to recognise two separate species from Europe as follows :

*Cortinarius violaceus* with spores (12)13-16(17) x 7-8(8.5)  $\mu\text{m}$ , elliptic to amygdaliform, verrucose, cap mostly 6-14 cm, under deciduous woods;

*Cortinarius hercynicus* with spores (12)13-16(17) x 7-8(8.5)  $\mu\text{m}$ , broadly ellipsoid to subglobose, strongly verrucose, cap mostly 5-10 cm, under coniferous woods (spruce, pine, sometimes mixed woods).

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Most records are only from the latter part of the twentieth century (May and Wood, 1997). The records are probably accurate because of the distinctive characteristics of *Cortinarius violaceus* s.l., but they give no information as to which of the currently reported species are intended. Later records indicate that the subgenus is widespread throughout most of Australia, but that it is not collected frequently.

Studies of DNA sequences of various species of *Cortinarius* concluded that there were grounds for considering the creation of two separate genera (Hoiland and Holst-Jensen, 2000). A later study of DNA sequences for a large range of *Cortinarius* species (Garnica et al, 2005) supported the *Cortinarius* clade, without any further additions of any closely related groups or species. Bougher and Syme (1998) used the epithet *C. violaceus* with some reservations for their local collections. Chambers et al. (1999) compared DNA from New South Wales material with reported sequences from Northern Hemisphere collections of *Cortinarius violaceus*, and reported that the local material while close, belonged to a different taxon and noted 'a careful revision of Australian *Cortinarius violaceus* collections is clearly required'. Unfortunately, voucher material of these collections has not yet been available.

Examination of material from mainland Australia has demonstrated close similarities to the European species but with some clear differences. All the Australian material does not belong to a single species but represents four different taxa of which three are new. The differences described below clearly indicate three distinct taxa, related to previously described species. The differences are sufficient to require the creation of three new species.

### MATERIAL AND METHODS

Material was mounted in 5% KOH solution and stained with Congo Red. Specimens are housed in the J.T. Waterhouse Herbarium, University of New South Wales (UNSW), except for Western Australian material, which is in the Western Australian Herbarium (PERTH). The collections at UNSW all have extensive field notes and colour photographs taken under standard conditions.

Spore measurements indicate the range of sizes found in the various collections. Where spore sizes are included in brackets, they indicate that the spore sizes were more than one measuring unit (0.3  $\mu\text{m}$ ) beyond the range for all other spores. The value Q

represents the mean length: breadth ratio of the spores. Measurements of Q were averaged for a collection and where a range is quoted it represents the range across collections. Measurements of the spores exclude the apiculus and the ornamentation. Measurements of cystidia indicate length and maximum width. Measurements of the basidia exclude the sterigmata.

Colours are usually followed by an annotation from Maerz and Paul (1950) and have a format such as 10D3. All colour comparisons were made under natural light.

The figures show the microscopic features at standard magnification: spores x2000, cystidia and basidia x1000. The scale bar represents 10  $\mu\text{m}$  at x2000 magnification.

### Key to the SW-Pacific species of *Cortinarius* subgenus *Cortinarius*

1. Average basidiospore length less than 10  $\mu\text{m}$ , cheilocystidia not capitate.....2
- 1\* Average basidiospore length more than 10  $\mu\text{m}$  .....3
2. Cheilocystidia 50-140 x 10-25  $\mu\text{m}$ , pleurocystidia scarce, 40-100 x 10-18  $\mu\text{m}$ , lanceolate.....*C. atroviolaceus*
- 2\* Cheilocystidia 30-48 x 4-7  $\mu\text{m}$ , pleurocystidia absent.....1.*C. jenolanensis*
3. Cheilocystidia capitate.....*C. austroviolaceus*
- 3\* Cheilocystidia not capitate or absent.....4
4. Spores with visible perispore .....*C. subcalyptosporus*
- 4\* Spores without visible perispore.....5
5. Cheilocystidia absent, pleurocystidia rare.....*C. paraviolaceus*
- 5\* Cheilocystidia present.....6
6. Spores large, at least up to 12  $\mu\text{m}$  long, mostly up to 16  $\mu\text{m}$  in length.....7
- 6\* Spores smaller, at most up to 12  $\mu\text{m}$  long, slender, Q 1.86, cheilocystidia lageniform, 45-70 x 12-20.....*C. atrolazulinus*
7. Spores ellipsoid to amygdaliform.....8
- 7\* Spores broadly ellipsoid to subglobose.....9
8. Spores elongate Q=1.87, width narrow, 6.3-7.5  $\mu\text{m}$ ; cheilocystidia 50-60 x 10-12  $\mu\text{m}$ , pleurocystidia frequent, similar.....*C. hallowellensis*
- 8\* Spores shorter Q=1.56, width broader 7.5-8.5  $\mu\text{m}$ ; cheilocystidia 35-80 x 15-25  $\mu\text{m}$ , pleurocystidia frequent, similar.....*C. violaceus*
9. Spores 11-13 x 8-9  $\mu\text{m}$ , Q=1.45; cheilocystidia 55-80 x 14-19  $\mu\text{m}$ , lageniform.....*C. hercynicus*

9\* Spores 11-14 x 8.1- 9.3  $\mu\text{m}$ , Q=1.40;  
cheilocystidia 45 – 120 x 14-17  $\mu\text{m}$ , lageniform  
.....3.*C. kioloensis*

5-6 cm longo, 5-8 mm crasso, sicco, appresse  
fibrilloso, pallidiori violacea. Sporis 8.4 – 10.2 x 5.7-  
6.9  $\mu\text{m}$ , Q=1.55, ellipsoideis, subtiliter verrucosis,  
cheilocystidiis sparsis, lageniformis 30-48 x 10-  
14  $\mu\text{m}$ , absentibus pleurocystidiis, absentibus  
pileocystidiis. Hyphis fibuligeris. Habitato in humo  
in silvis *Eucalyptus* mixtis.

1. *Cortinarius jenolanensis* Wood, sp. nov. (Fig.  
1: a-d)

Pileo usque ad 4 cm lato, convexo, demum plano,  
obscure violaceo, sicco, subtiliter fibrillo-squamoso.  
Lamellis obscure violaceis, brunnescentibus. Stipite

Pileus to 4 cm, hemispherical at first, then convex  
to flat convex and finally plane, very finely to a little  
coarsely radially fibrillose, deep violet, dry, not

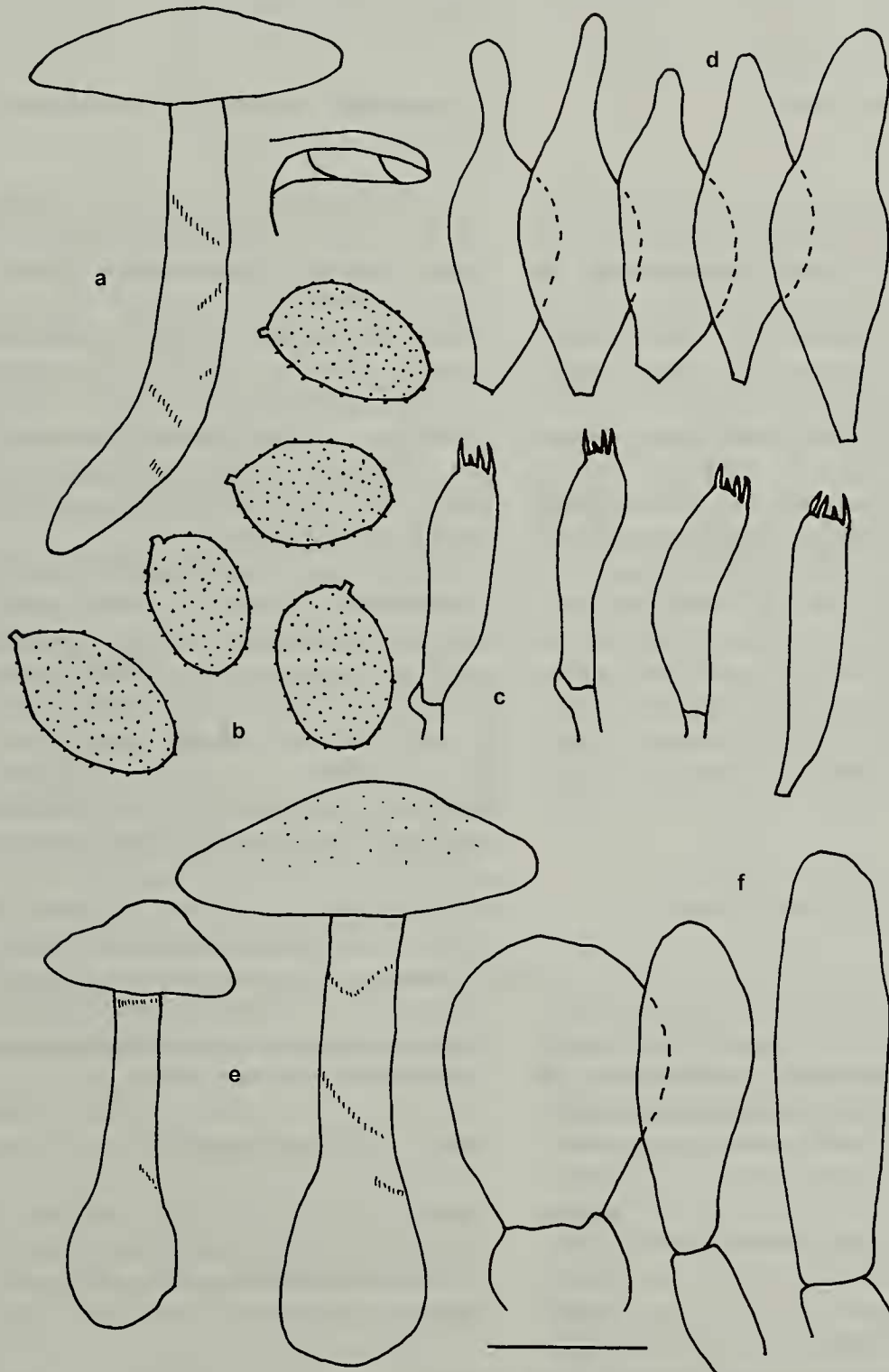


Figure 1. *Cortinarius jenolanensis* (UNSW 88/107) : a. basidiome (x 1); b.spores; c.basidia; d. cheilo-  
cystidia; *Cortinarius kioloensis* (UNSW 83/781) e. basidiome(x 1) f. pileocystidia.

hygrophanous. Lamellae broadly adnate to slightly decurrent, thin, crowded, with one to two series of lamellulae, deep violet then deep ferruginous, margin concolorous. Stipe 50-60 x 5-8 mm, central, firm to tough, equal to slightly swollen below, sometimes slightly tapering at the base, upper part cap coloured or slightly paler, lower part a little paler with base pale violet, with no obvious basal mycelium, and no clear zone of velar remains. The only velar remains were a few scattered appressed fibrils throughout with only small areas or groups.

#### Aroma

There is no apparent aroma.

#### Spores

8.4-10.2 x 5.7-6.9  $\mu\text{m}$ , mean 9.44 x 6.09  $\mu\text{m}$ , mean  $Q = 1.55$ , oval, suprahilar depression not clearly present and not clearly smooth, ornamentation low to very low, a little blunt, not anastomosing. Basidia 25-32 x 11-14  $\mu\text{m}$ , clavate, four-spored; clamp connections present. Cheilocystidia fairly sparse, variously lageniform (some somewhat irregular) 30-48 x 10-14  $\mu\text{m}$ , pleurocystidia absent. Pileal cuticle a loose layer of narrow hyphae, each 4-7  $\mu\text{m}$  diameter, not encrusted with pigment, mainly radially arranged and repent, a few a little irregularly loose and more or less upright with rounded terminal cells but not specialised as pileocystidia. Below this layer was a densely packed layer of parallel hyphae, the layer about 40-50  $\mu\text{m}$  thick with individual hyphae of 4-10  $\mu\text{m}$  diameter. Below this layer was a layer of interwoven hyphae, somewhat compact, of pale golden hyphae with individual hyphae of 5-8  $\mu\text{m}$  diameter.

#### Habitat

On soil in eucalypt sclerophyll forest.

#### Commentary

This species is different from all the species described by Moser (1987) because of the smooth pileus, different structure of the cuticle, absence of pleurocystidia, without amorphous deposits and also by being of smaller general size and lacking aroma.

It is close to the typical forms of *Cortinarius atroviolaceus* but differs in having slightly smaller spores which are more finely rough and lack a clearly visible plage, the complete absence of pleurocystidia and smaller cheilocystidia. It may be that Corner Collection RSNBB 5258B, noted by Moser (1987), which has finer ornamentation on the spores and smaller cheilocystidia, also represents this species. *Cortinarius austroviolaceus* is also close, but that

species has cheilocystidia that are regularly slightly capitate and are more variable otherwise, and it also has a different cuticle with occasional lanceolate (lageniform) terminal cells. (See Moser 1987, pp 139,140).

#### Material Examined

NSW : Jenolan Caves, Binda Cabins, Eucalypt woodland, 30.4.88, A.E. Wood et al. (UNSW 88/107) Holotype; ACT, Canberra, Tidbinbilla Nature Reserve, Eucalypt woodland, 16.5.92, A. E. Wood et al. (UNSW 92/121).

#### 2. *Cortinarius kioloensis* Wood, sp. nov. (Fig. 1: e,f; 2: a-c)

Pileo usque ad 6 cm lato, convexo, demum plano, obscure violaceo, sicco, fibrilloso-squamoso. Lamellis obscure violaceis, brunnescentibus. Stipite 8-12 cm longo, 15 mm crasso, basi clavatus usque ad 30 mm crasso, sicco, appresse fibrilloso, pallidiori violacea. Sporis 11.1 - 13.5 x 8.1 - 9.3 (10.5)  $\mu\text{m}$  ellipsoideis. verrucosis, cheilocystidiis lageniformis, 45-120 x 14 - 19  $\mu\text{m}$ , pleurocystidiis sparsis, lageniformis 45-113 x 15 - 26  $\mu\text{m}$ , pileocystidiis cylindricis vel fusiformis 35-60 x 13 - 28  $\mu\text{m}$ . Hyphis fibuligeris. Habitato in humo silvis *Eucalyptus* mixtis.

Pileus to 6 cm diam., rounded convex at first, then rounded umbonate to convex, finally almost plane with age, strongly fibrillose to a little tomentose to finely squamulose, more adpressed with age, deep violet (48H11-12), becoming blackish with age, dry, not hygrophanous. Lamellae narrowly to broadly adnate to slightly sinuate, thin to moderately thick, somewhat spaced, one or two sets of lamellulae, dark violet at first, then gradually deep ferruginous, margin concolorous. Stipe central, firm, solid, bulbous at base, 8-12 x 1.5 cm, base 3 cm, dry, mostly with clear fibrillar velar zone and scattered fibrils below, violet above, somewhat paler than cap, a little paler below (to 46E6 - 17E4), basal bulb globose, concolorous. Flesh whitish to pale violet, outer layer of stem dark violet, deep violet at apex of stipe.

KOH (5%) on cap bright red.

#### Aroma

Clearly absent even when quite young and fresh; one collection with slight aroma of wood shavings (but not camphor wood).

#### Spores

11.1-13.5 x 8.1-9.3 (10.5)  $\mu\text{m}$ , mean 12.5 x 8.8  $\mu\text{m}$ ,  $Q = 1.37-1.46$ , grand mean  $Q = 1.42$ ,

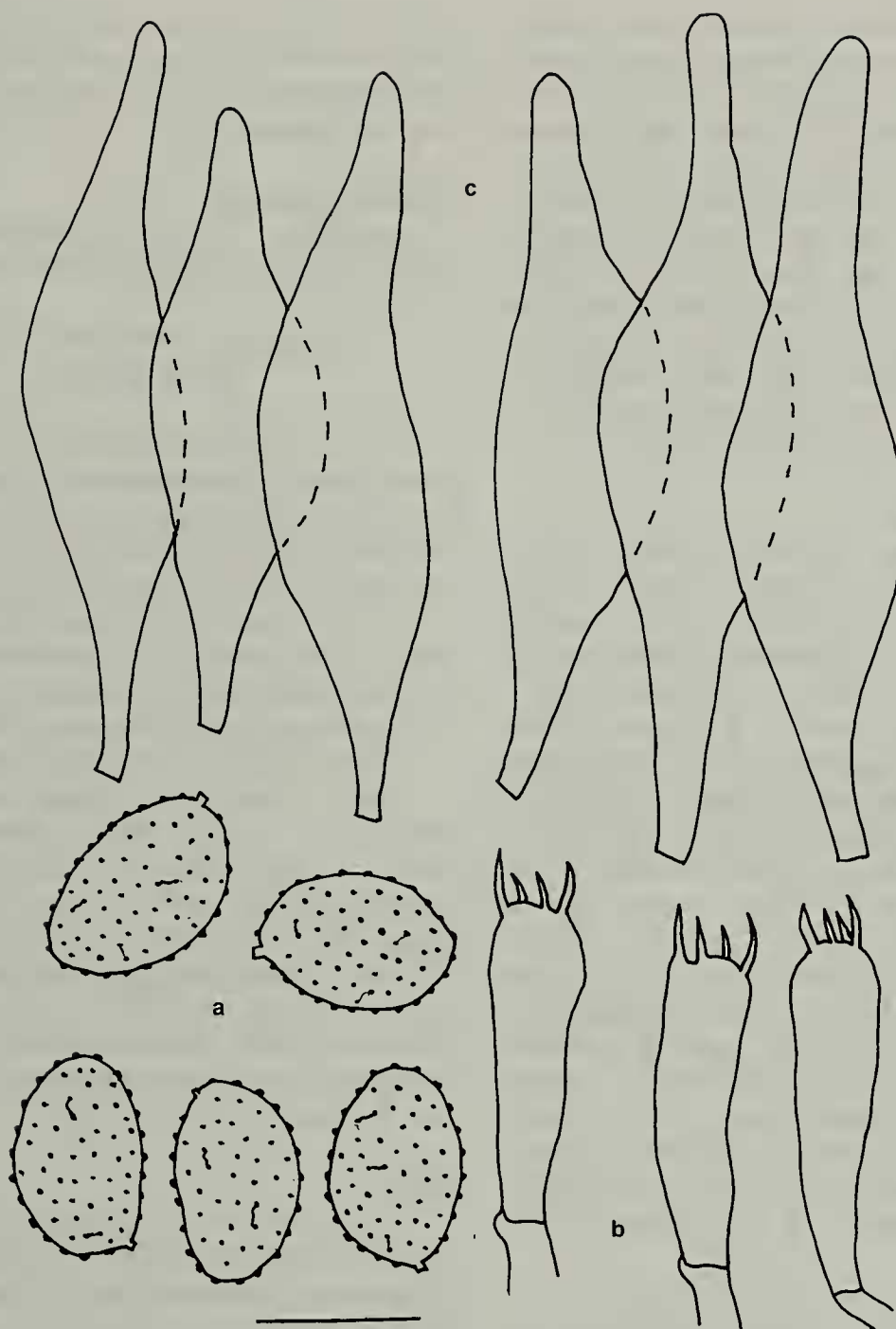


Figure 2. *Cortinarius kioloensis* (UNSW (83/781) : a. spores; b. basidia; c. cheilocystidia

ovoid to elliptic, suprahilar depression not marked but present in some cases, but not clearly smooth, ornamentation moderate, coarse, blunt, with some slight anastomosing. Basidia 35–50 x 10–12  $\mu\text{m}$ , four-spored; clamp connections present. Cheilocystidia abundant, ventricose to lageniform, 45–120 x 14–19  $\mu\text{m}$ ; pleurocystidia sparse but clearly present, similar to cheilocystidia, but with some a little fusoid, 45–113 x 15–26  $\mu\text{m}$ . Pileal cuticle a layer of loose hyphae with upturned terminal cells which are somewhat inflated, swollen or cylindrical, 35–60 x 13–28  $\mu\text{m}$ ; subcuticular layer of subcellular cells, 30–40  $\mu\text{m}$  diameter, walls not coloured, below this a narrow

layer of somewhat inflated, closely packed hyphae, 20–25  $\mu\text{m}$  diameter, with coloured contents, below this the context was of loosely arranged somewhat inflated hyaline hyphae, 15–25  $\mu\text{m}$  diameter.

#### Habitat

On soil in eucalypt sclerophyll forest.

#### Commentary

This species is different from the typical forms of *Cortinarius violaceus* and *C. hercynicus* and from all the other species described by Moser (1986). It is distinct because of the different habit, absence of

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aroma, relative scarcity of pleurocystidia, presence of pileocystidia and spores which are without a well-differentiated plage and have less well developed wall ornamentation. There are also some slight differences in the size and shape of the spores. In this species, the size and shape are nearer to that found in *Cortinarius hercynicus* rather than that found in *Cortinarius violaceus* but the shape seems distinctly different from that of spores of *Cortinarius hercynicus* in that the spores are broadly ellipsoid rather than distinctly amygdaliform. Because of all these features it is regarded as a distinct taxon and is described as a new species of *Cortinarius* near to *C. hercynicus*.

### Material Examined

NSW: Sydney, Scotland Island, Eucalypt woodland, 22.6.80, S. Lowry, (UNSW 80/268); Batemans Bay, Kioloa State Forest, Eucalypt woodland, 19.5.83, A. E. Wood & J. J. Bruhl, (UNSW 83/781) Holotype; Sydney, Royal National Park, Eucalypt woodland, 5.6.83, F. K. Taeker, (UNSW 83/923); Batemans Bay, Kioloa State Forest, Higgins Creek, Eucalypt woodland, 15.5.84, A. E. Wood & N. B. Gartrell, (UNSW 84/495); Sydney, Royal National Park, Couranga Track, Eucalypt woodland, 28.5.86, F. K. Taeker, (UNSW 86/254); Sydney, Boronia Park, Eucalypt woodland, 27.5.90, R. Kearney, (UNSW 90/197); Hazelbrook, James Park, Eucalypt woodland, 30.5.92, A. E. Wood et al., (UNSW 92/206); Springwood, Sassafras Gully, Eucalypt woodland, 16.4.94, A. E. Wood et al., (UNSW 94/47); Sydney, Sydney Harbour National Park, Bradleys Head, 7.6.98, B. J. & N. W. Rees, (UNSW 98/25); Sydney, Lane Cove Bushland Park, Gore Creek, Eucalypt woodland, 7.6.98, B. J. & N. W. Rees, (UNSW 98/28).

Authentic material from Sweden (Femsjo) was collected and at first was identified as *Cortinarius violaceus*. However later detailed examination clearly showed that it was a typical example of *Cortinarius hercynicus* and the following microscopic details are added for this collection (as *Cortinarius hercynicus* var *hercynicus*)

### Spores

12.6-15.0 x 8.4-9.3  $\mu\text{m}$ , mean 13.47 x 8.94  $\mu\text{m}$ , Q = 1.51, spores elliptic, only vaguely amygdaliform, with only some spores showing a slightly flatter supra-hilar depression, but that mostly not smooth, ornamentation moderate, a little broad and only slightly blunt. Cheilocystidia frequent 75-85 x 13-19  $\mu\text{m}$ , narrowly lageniform, pleurocystidia sparse but clearly present, lageniform, somewhat more variable,

50-90 x 12-20  $\mu\text{m}$ . Pileal cuticle of closely packed and interwoven hyphae, layer 100-200  $\mu\text{m}$  deep, individual hyphae 5-7  $\mu\text{m}$  diameter, without any terminal cystidia (Fig. 3).

### Material Examined :

SWEDEN: Femsjo, woodland, 2.9.79, M.M. Moser & A.E. Wood, in UNSW (UNSW 79/29).

### 3. *Cortinarius hallowellensis* Wood, sp. nov. (Fig. 4)

Pileus usque ad 6 cm lato, convexo, demum plano, obscure violaceo, sicco, subtiliter fibrilloso-squamoso. Lamellis obscure violaceis, brunnescentibus. Stipite cylindrico vel clavato, 4-7 cm longo, 10-15 mm crasso, basi leviter, sicco, fibrilloso violacea. Sporis 11.1-12.0 x 6.3-7.5  $\mu\text{m}$ , ovoideo-ellipsoideis, verrucosis, cheilocystidiis fusiformis vel lageniformis, 50-60 x 9-13  $\mu\text{m}$ , pleurocystidiis fusiformis, 50-60 x 9-13  $\mu\text{m}$ , absentibus pileocystidiis. Hyphis fibuligeris.

Habitato in humo in silvis *Eucalyptus* mixtis.

Pileus to 3.4-6.0 cm, rounded convex at first, flattening at maturity, finely radially fibrillose, very dark violet brown (16F4), not hygrophanous. Lamellae broadly adnate to adnate, thin, a little spaced, dark violet (16B5), more rusty with age, with two series of lamellulae. Stipe cylindrical to clavate, with a swollen base 3.7-7.0 x 1.0-1.5 cm, solid, dry, dark violet (16B4) with fine cobweb veil, rapidly disappearing (after Bougher & Syme 1988, colours from Kernerup & Wanscher, 1978).

### Spores

11.1-12.0 x 6.3-7.5  $\mu\text{m}$ , mean 11.49 x 6.81  $\mu\text{m}$ , mean Q = 1.69, oval to elliptic, occasionally vaguely amygdaliform, with occasionally a slight supra-hilar depression, but not visibly smooth, ornamentation moderate, coarse, blunt. Basidia cylindrical to clavate, 40-55 x 10-12  $\mu\text{m}$ , four-spored, clamp connections present. Cheilocystidia plentiful, narrow lageniform to fusoid, 50-60 x 9-13  $\mu\text{m}$ , pleurocystidia sparse, but clearly present, similar to cheilocystidia, but mostly fusiform 50-60 x 10-12  $\mu\text{m}$ . Pileal cuticle with a surface layer 35-50(80)  $\mu\text{m}$  deep, a thin layer of loosely arranged hyphae, individual hyphae 2.5-5  $\mu\text{m}$  diameter, mainly repent, with no erect hyphae and no differentiated terminal cells, without wall encrustation, some walls with pale golden walls; below this a layer of closely packed cylindrical hyphae of the trama (35-50 x 7-10  $\mu\text{m}$ , some a little larger and a few pseudoparenchymatous cells present).

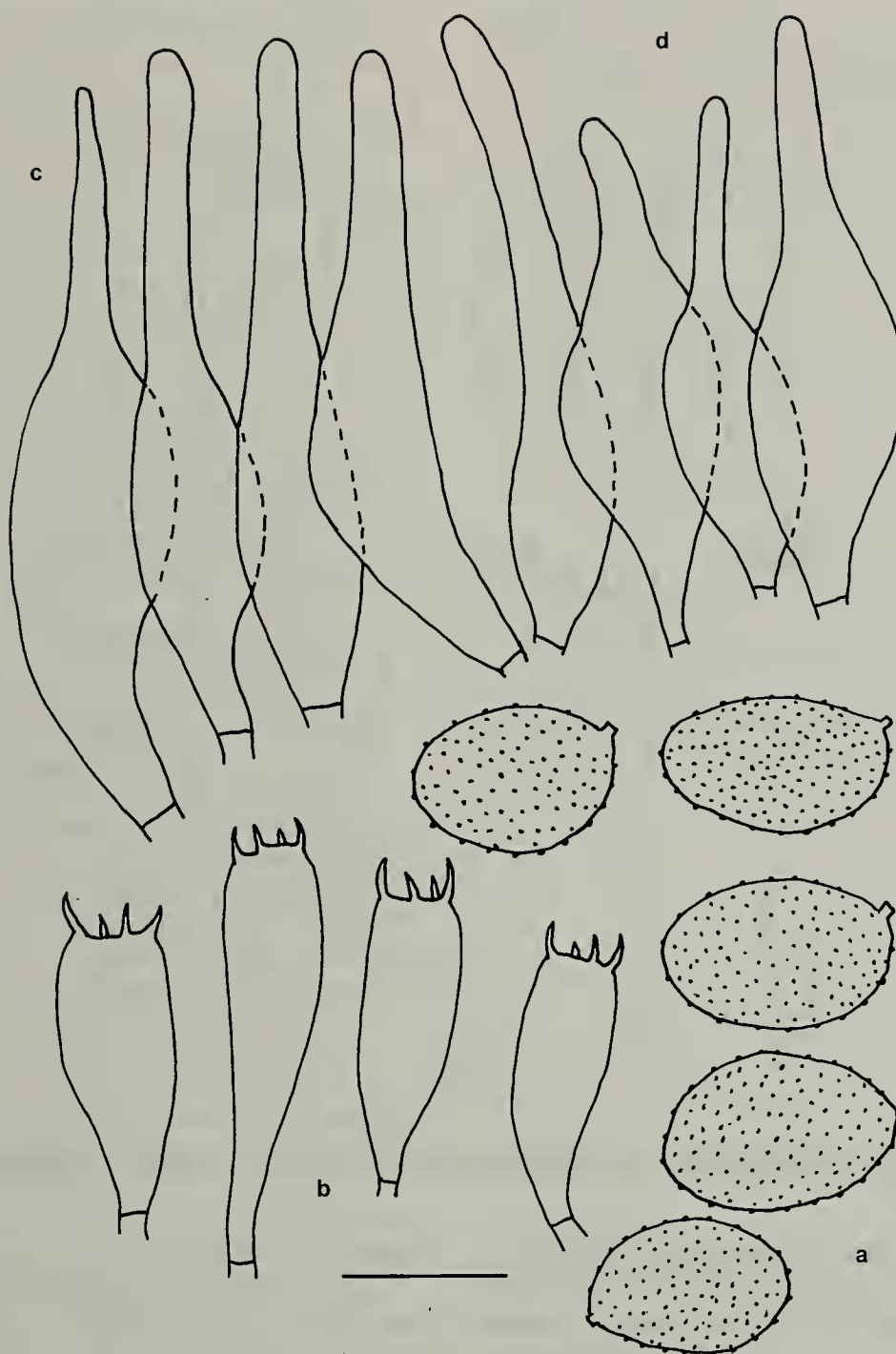


Figure 3. *Cortinarius hercynicus* (UNSW 79/29) : a. spores; b. basidia; c. cheilocystidia; d. pleurocystidia

**Commentary**

This species is different from the typical *Cortinarius violaceus* in that this species has oval to elliptic spores ( $Q = 1.69$ ), rather than amygdaliform spores, the cuticle does not produce pileocystida, the cheilocystidia are narrower to fusiform and the general habit is much smaller. Hence it is regarded as a close, but distinct species.

**Material Examined**

WA: Denmark, Mount Hallowell Reserve,

Eucalypt woodland, 22.5.93, K. Syme. (PERTH 0550 6794), Holotype.

Collection PERTH007775665 also seems to be this species. However it was collected in a *Pinus radiata* plantation. It has spores with size 12-13.8 x 6.6-7.5  $\mu\text{m}$ , mean 13.14 x 7.02  $\mu\text{m}$ ,  $Q = 1.87$ , spores ovoid to elliptic, some vaguely amygdaliform, supra-hilar depression sometimes slightly present, but never clearly smooth. Cheilocystidia abundant, narrow lageniform to narrow fusiform 85-110 x 10-



Figure 4. *Cortinarius hallowellensis* (PERTH 0550 6794) : a. spores; b. basidia; c. cheilocystidia; d. pleurocystidia.

12  $\mu$ m, pleurocystidia abundant, narrow fusiform of the same dimensions. Pileal cuticle a thin, scarcely differentiated layer 20-30  $\mu$ m deep, composed of narrow hyphae, 2-5  $\mu$ m diameter, the surface slightly more loosely arranged, but with no special terminal cells and no upturned cystidia and then the underlying tissues gradually becoming more densely packed. This collection has slightly larger spores and slightly longer cystidia, but does not otherwise differ from the previous collection. In the absence of further collections, this is left as another collection of *Cortinarius hallowellensis*. This leaves the question as to whether this form is a local form which has transferred to the introduced host or whether it was introduced with the exotic species, and may occur elsewhere. Much more extensive collecting may allow this question to be answered.

#### Material Examined

WA.: North of Jarrahdale, *Pinus radiata* plantation, 2.6.76, M. Durack.  
(PERTH 00775665).

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